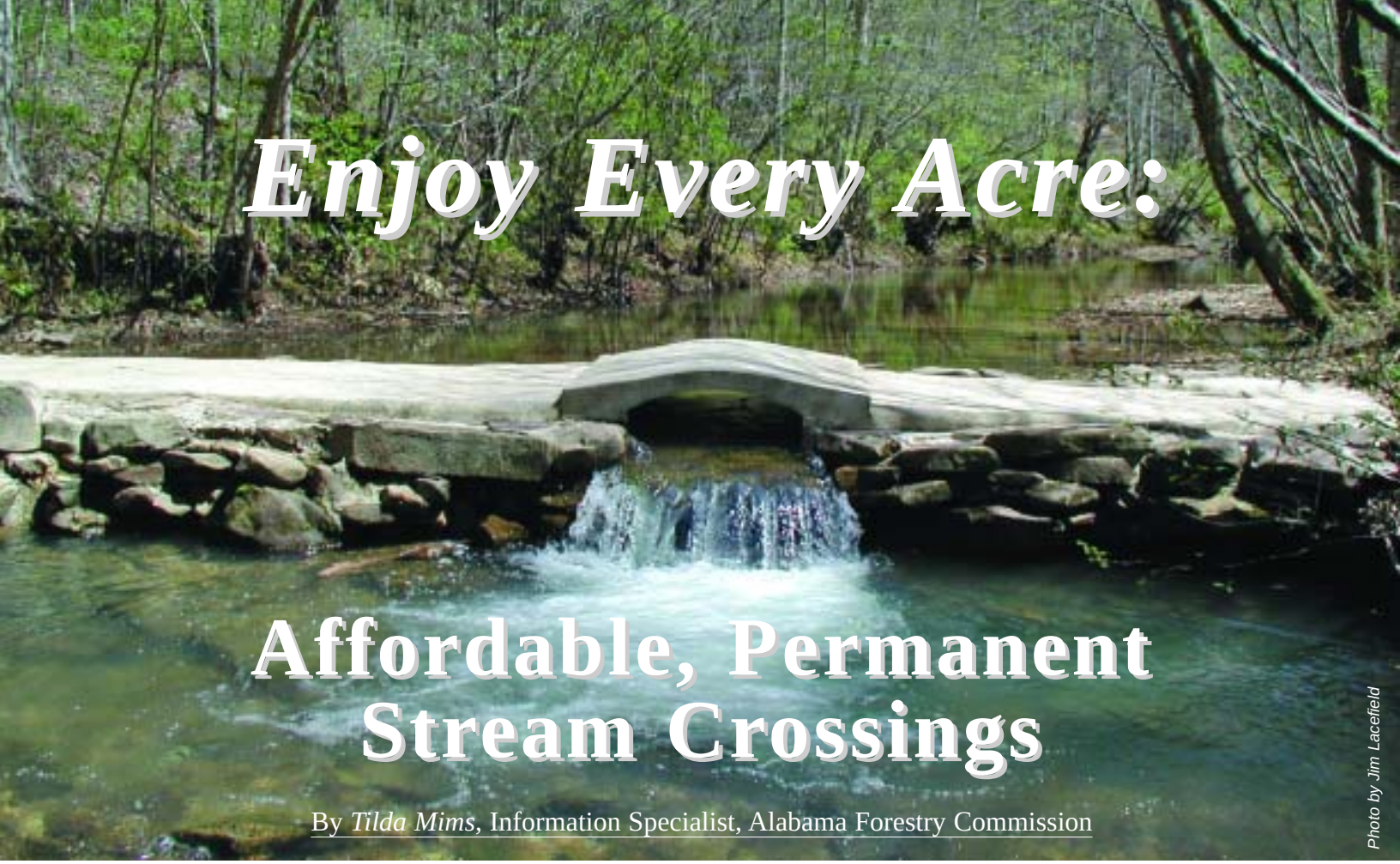


Enjoy Every Acre:

Affordable, Permanent Stream Crossings

By *Tilda Mims*, Information Specialist, Alabama Forestry Commission

Photo by Jim Lacefield

Sandstone slabs from Cane Creek were hand stacked around spillway sections formed of concrete to span larger streams with deeper streambeds.

Most Alabama landowners easily develop a useful trail system to provide access for harvesting timber, monitoring the growth and health of the forest, exercising, recreation, education, and observing nature. However, many trails eventually cross streams and creeks, and development becomes a little more complex. Providing access to and through forestland and other natural resources safely and inexpensively may seem impossible.

Fortunately, whether you want to move heavy equipment over a stream or simply extend your walking path to the far side of the lake, there are innovative approaches available at a reasonable price. This article discusses designing affordable stream crossings to facilitate travel, reduce erosion, and protect plants, animals and scenery. It takes a close look at two TREASURE Forests with innovative bridges of natural and recycled materials that provide uninterrupted scenic corridors in the natural landscape.

Crossing structure designs vary, depending on the length and height of the crossing, amount and weight of traffic, and the needs of the landowner.

LOW-WATER CROSSINGS — Low-water bridges provide a solid route across muddy, rocky, or unstable streams during all but times of the highest floods. They are slightly raised above streambeds to allow floodwaters to pass easily over them, carrying downed trees and debris with little damage to the structure. They usually incorporate culverts or other drains. If designed well, the bridge's surface will remain above water level for better than 95% of the year, making crossing easy on equipment and vehicles.

Dr. Jim Lacefield constructed several low-water stream crossings on his Colbert County TREASURE Forest, Cane Creek Canyon Nature Preserve, using concrete and natural stone that blend beautifully into the natural landscape.

Footbridge – The footbridge that crosses just above a big waterfall gets people safely across a solid rock creekbed that is usually very slippery. During a low water period, Jim placed a pair of heavy 5/8-inch bolts into holes pounded into the sandstone creek bed using a small sledgehammer and a concrete bit. The holes were drilled eight feet apart to help anchor the bridge. He then placed 8x16-inch concrete blocks over the bolts with their narrow end pointed toward the current, leveled, and filled with concrete. Similar anchors were placed in the creek bank. Concrete – tinted to match the surrounding sandstone – was molded around the blocks to create rounded, naturally shaped pedestals for the footbridge.

When the concrete set, he placed a pair of treated landscape timbers between each pedestal. Finally, two rough-sawn red oak 2x12-inch boards were placed end to end on top of the landscape timbers, centered, and attached to the timbers with large deck screws. This bridge has now survived a number of major floods and is still in place.

Materials: $30. Advantages: aesthetically pleasing, blends with the environment. Disadvantages: somewhat labor intensive, potentially vulnerable to large

debris washed downstream during floods. Maintenance: future maintenance may be required.

For bridges large enough to carry vehicles, low water bridges have distinct advantages over truss-type bridges. They are less costly to build, less vulnerable to damage during major flood events, blend well with the environment, can be constructed with natural materials found on the spot and, if carefully constructed, can have very few long-term maintenance problems.

Concrete Culvert Bridge – The Lacefields used a simple culvert bridge on rocky and uneven area for vehicle crossing. During low-stream flow, three sections of 12-inch diameter concrete culverts were placed end-to-end, straightened to align with the creek flow, and held in place by placing rocks under their edges. A second set of culverts was set in place nearby. Sandstone slabs and cobbles from the creek bed – stacked around the culverts to each bank – outlined the shape of the bridge.

The concrete was mixed from a combination of clean sand and gravel from the creek and Portland cement. The natural ratio of gravel to sand in this creek was about right for producing high quality concrete, so it was easily produced on the spot, far from any improved road. A 1/3 cubic yard portable concrete mixer powered by a small tractor was used to stir the mixture.

Jim uses an acrylic concrete additive in his pours to make them more durable and to help them cure better and stronger. If the current in the stream is not too strong, concrete can be poured right into the form in the water. Concrete actually cures better under water than when exposed to drying, but you have to be careful not to pour into water so swift that the concrete powder is separated from the aggregate.

Photo by Jim Lacefield

An acrylic concrete additive in this simple footbridge makes pedestals more durable and helps them set better and stronger.

According to Jim, a good quality concrete mixture that should test well over 3,000 pounds per square inch can be made by mixing three parts gravel to two parts sand to one part Portland cement. Blending five parts gravel, three parts sand, and one part Portland cement makes a less expensive (but still quite strong) mixture, useful for many purposes.

Materials: $140. Advantages: less expensive, well protected from flood damage, low maintenance. Disadvantages: somewhat crude appearance, requires a lot of hand labor stacking rocks.

Formed Concrete Curving Bridge – A formed, curving low-water bridge crosses a rough and uneven area prone to rare, extreme floods. It contains three small culverts that allow normal flows to pass beneath the surface of the bridge which remains dry 95% or more of the year.

Three 10-foot long, 4-inch diameter PVC pipes were placed in the stream channel during a low-flow period and aligned with the stream direction of flow. A box form built around them was filled with high strength concrete to a depth of four inches deeper than the top of each pipe. On each side of this center bridge section, curving outer sections were formed using flexible concrete siding board. Both sides were measured to slope downward toward the middle section containing the drainpipes, and a slight, banked curve was built into the design to accommodate a curve in the access road at the point of the creek crossing. Three hand-mixed pours were required to complete the bridge.

Materials: $250. Advantages: looks good, well protected against even extreme floods, very durable, low maintenance. Disadvantages: requires careful measurement and forming slope, labor intensive.

Stacked Stone Bridges – Sandstone slabs from Cane Creek were hand-stacked around spillway sections formed of concrete to span larger streams with deeper streambeds. These low-water bridges still let most flood water pass over the top, but are raised up higher from the streambed to accommodate steeper banks. Spillway sections were formed of plywood and poured before the broader portions were stacked and poured. Each has a bridge surface of placed and troweled hand-mixed concrete.

Materials: $325. Advantages: hand-stacked stone results in massive structure well protected against floods. Disadvan-

Photo by Jim Lacefield

Concrete culverts are a mainstay of forest trail construction and with a little imagination, they easily blend into natural surroundings.

(Continued on page 10)


Photo by Jim Lacefield

This curved low-water bridge contains three small culverts that allow normal flows to pass beneath the surface of the bridge, which remains dry 95% or more of the year.

tages: labor intensive, periodic cleaning of debris that collects around the spillway area during floods.

WIDE OR DEEP WATER CROSSINGS — Wider or deeper areas may be crossed with several permanent bridge designs. Many landowners find sturdy recycled materials to be excellent choices, such as flatbed truck trailers and utility poles.

Flatbed Truck Trailer – On Mike and Cathy Strong's TREASURE Forest in Shelby County, a 45-foot flatbed truck trailer purchased for $600 stretches across 40 feet of Yellow Leaf Creek. The heavy-duty construction of the trailer, rated for 45–50,000 pounds, allows the Strongs to move trucks, dozers, and other equipment used for routine farm work with no problem. It also increases accessibility of fire suppression equipment into all parts of the farm.

The construction began by imbedding two steel I-beams into the banks on each side of the creek and securing them with concrete to form a foundation. Cables attached to the trailer allowed it to be pulled into place by a loader. The wheels were removed from the trailer with a torch before placement. Mike says it is very important to weld the trailer onto the I-beams to hold it in place and resist damage from floating debris.

Bridge decking of 3x10-inch creosote boards is topped by steel straps the length of the bridge. Every third board was drilled to accept 6 to 8-inch carriage bolts that pass through steel washers, the steel strap, the creosote boards, and into the strap holes on the underside of the trailer.

Materials: Mike estimates an investment of $1,500-1,800 in materials beyond the cost of the trailer more than eight years ago. Advantages: very sturdy, and at certain times of the year, water is over the bridge by as much as five feet. Does not collect debris from the stream. Disadvantages: none. Maintenance: minimal.

Telephone Poles – In another area of their farm, a spillway area was easily spanned with a structure made of surplus 18 to 20-inch telephone poles. For only about $500 in supplies, a 40-foot bridge makes it a snap to cross the area, even during wet weather.

A local sawmill removed a 6 to 8-inch strip on each of three main support poles for attaching floor timbers and sawed other poles into 3x8-inch flooring. Poles extend about 36 inches into either bank to hold the bridge in place. Flooring was attached with countersunk bolts. Unopened bags of Kwikrete wedged into areas between the bridge and the bank keep water from eroding the soil at the ends of the bridge. As the bags absorb moisture, they harden and, as the bags disintegrate, they resemble a boulder that matches the landscape.

Materials: $500. Advantages: less expensive than traditional concrete culverts, very sturdy – carries up to 14,000 pounds. Disadvantages: none. Maintenance: a wood preservative on the bridge yearly.

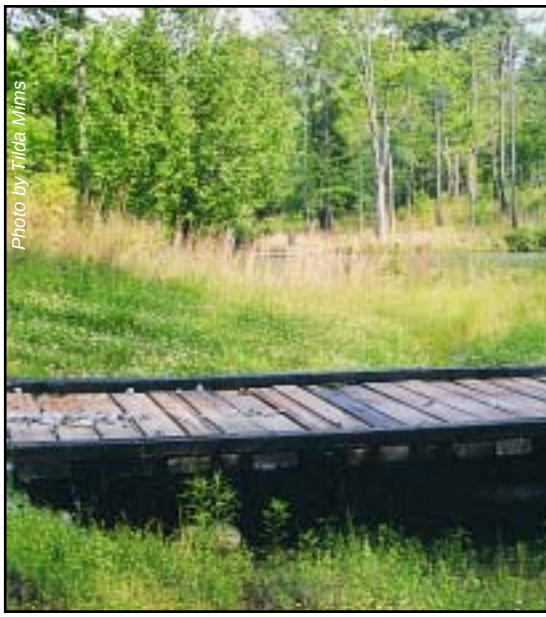


Photo by Tilda Mims

A 40-foot bridge made of surplus 18 to 20-inc spillway area, even during wet weather.

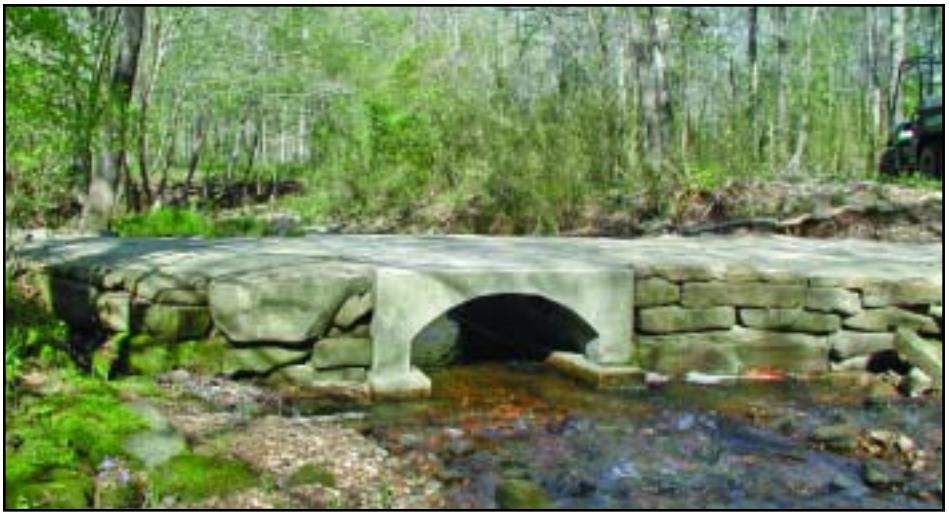


Photo by Jim Lacefield

These low-water bridges still allow most flood water to pass over the top, but are raised up higher from the streambed to accomodate steeper banks.

A 4x50-foot swinging footbridge made of old cable and scrap wood already on the farm allows attractive, economical access to a small island on another area of the farm. Two 8-inch steel poles were sunk in about three feet of concrete on each bank. Flooring of 1x6 pressure treated wood was connected to steel cables with conduit brackets and pulled into place with a tractor. The cables were pulled taut and are held in place with cable clamps. Loops in the cable were retained for tightening the cables as needed.

Materials: items already on the farm. Advantages: attractive and economical. Disadvantage: not accessible for disabled guests. Maintenance: none.

An arched 40-foot wooden bridge near the Strong's home was a reasonable investment for multi-functional access. It completes the walking trail around the farm and allows ATV travel. Its high arch allows bass boats to pass underneath accessing all parts of the lakes.

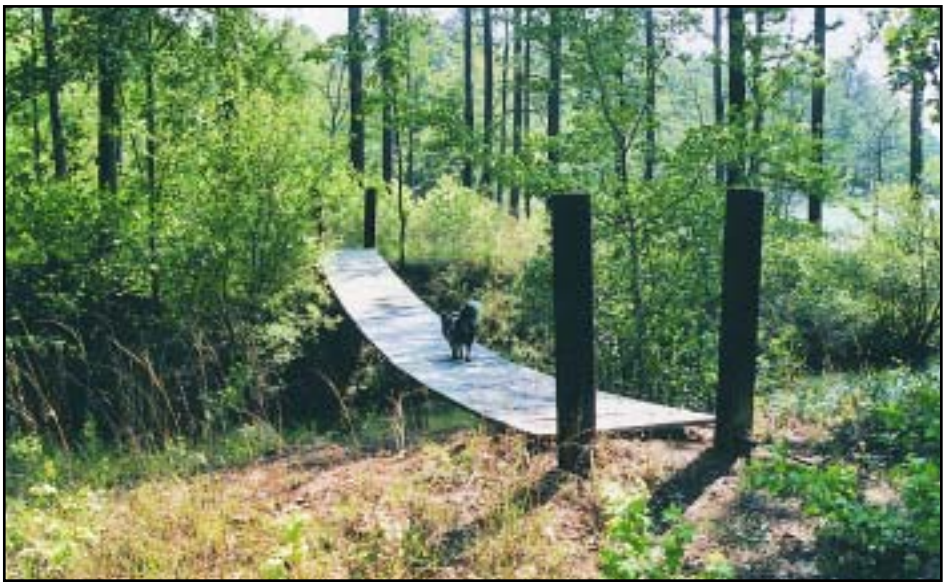
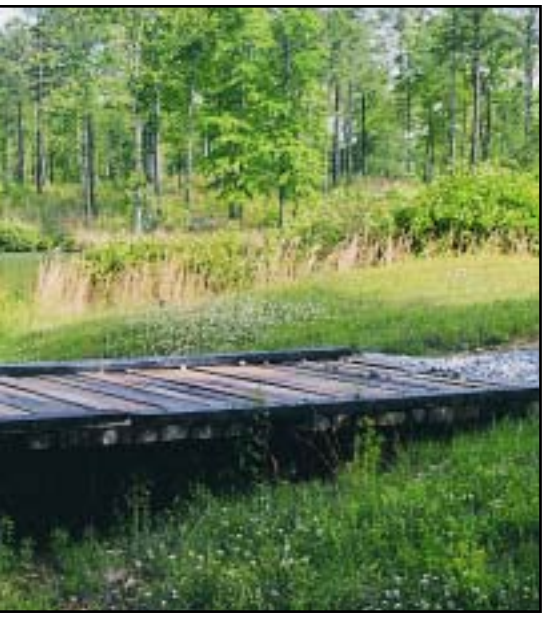


Photo by Tilda Mims

The swinging footbridge makes it easy for Rocket to explore the island when he doesn't feel like swimming.



h utility poles makes it a snap to cross the

Two arches of 2x12s were constructed in the barn in about four days. They are made of straight boards cut to be an arch. They were moved into place and attached to pressure treated 6x6-inch posts in concrete footings. The decking of 2x6 lumber completes an overall bridge length of 40 feet.

Materials: $1,200-1,500. Advantages: multiple function, height allows boat access. Arching shape adds interest to the landscape. Disadvantages: none. Maintenance: minimal.

Stream crossings discussed in this article have a sturdy grounded feel – as if they are natural parts of the farm. Simple lines, heavy timbers, and use of natural materials such as native stone integrate them into the landscape.

In most cases, the structures make crossings accessible for those with a variety of disabilities including sight, hearing, mental, heart or lung disease, and ambulatory limitations. Visually-impaired users benefit from definite edges such as sturdy handrails or tire rubs. Decking boards placed perpendicular to the trail path, with gaps between boards not exceeding 3/8-inch, ensure safe passage for visitors in wheelchairs.

Hiking, nature observation, hunting, horseback riding, and afternoon strolls are only a few of the opportunities that a stream crossing may provide. They also furnish access to monitor forest conditions and identify problems, helping develop a foundation for long-term forest management.

A carefully planned crossing structure is more than a connection between two points. It is a means of bringing you, your family, and guests in contact with the forest – and making it an enjoyable journey.

Photo by Tilda Mims

The heavy-duty construction of the trailer allows safe passage of heavy equipment used for routine farm work.

Resources:

Rails to Trails Conservancy

Trails, Bridges and Boardwalks www.extension.uf.edu

USDA Forest Service, Wood in Transportation National Information Center http://wit.fsl.wvnet.edu

USDA Forest Service, Forest Products Lab http://www.fpl.fs.fed.us/wit/

Recreational Trail Design and Construction at www.extension.um.edu